Space Weather Technical Forecast

Issued on Sunday, 24 October 2021 at 13:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Daily Slight Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low through the period, with only B-class flares observed. There were two numbered sunspots on the disc in the period: the first, AR2886 a simple unipolar Hsx/Alpha group near the solar meridian, with this spot stable and inactive. The second, AR2887 was larger and more complex, almost taking the guise of a pair of co-rotating regions, but for being combined in HMIBC imagery and with their plages interconnected. This group was assessed as a Dki/Beta, with minor proliferation evident in its southern spots and an increase in diameter of the northern penumbra, leading to overall areal growth. There two bright flux regions on the southeastern limb, at least one of these may contain a small spot, which will become more apparent as it rotates further onto the visible disk.
While there are numerous small filaments on the solar disc at present, these appear stable at the time of writing. All observed Coronal Mass Ejections (CMEs) in available satellite imagery were peripheral - mostly from behind the eastern limb - with none thought to have an Earth-directed component.

Solar Wind / Geomagnetic Activity: The solar wind was at background levels through the period, with the solar wind speed measured by DSCOVR at L1 ranging between 340 km/s and 390k m/s. The solar wind density initially showed a flat trend with mid-single figures ppcc, before rising to just above average at times after 24/0001UTC, while the IMF was unremarkable and stable at or below 6nT throughout. The north-south component of the IMF therefore had little scope for variation, reaching limits of +/-5nT, while the phi angle remained predominantly negative (towards the sun).
The net result of the preceding solar wind measures was Quiet Kp throughout, (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured by GOES-16 was at Background levels, with no solar radiation storms observed. High energy electron flux (greater than 2MeV) was predominantly at background levels. Associated 24-hour electron fluence was well below the Active (1e8 integrated pfu) threshold, with 1.69e6 integrated pfu recorded at 24/0001UTC.

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Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily Slight Chance of M-class flares, largely the result of the complexity of AR2887, although this has yet to be borne out in observed X-ray activity. There are possible returning regions now lying on the southeast limb and perhaps just over the northeast that may yet increase probabilities over the next few days, however these do not yet feature in the percentages.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period, and no coronal hole high speed streams are expected to arrive. A Quiet geomagnetic forecast is expected to be the result.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels, with no solar radiation storms currently expected. The high energy electron flux (greater than 2MeV) is likely to remain at Normal Background levels, with the 24-hour fluence expected to remain well below Active.

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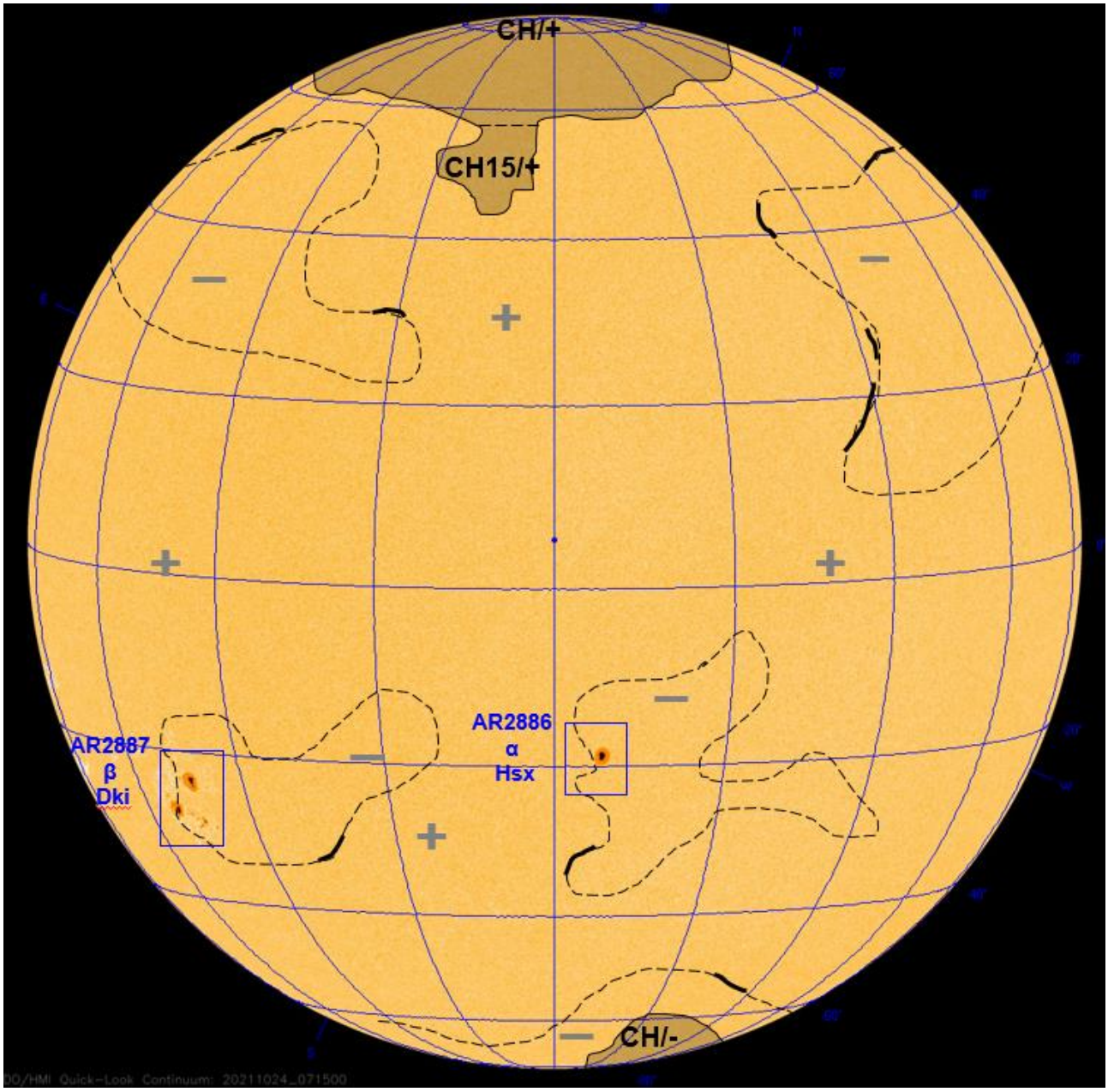
Figure 1. Solar Analysis Valid 24/0800UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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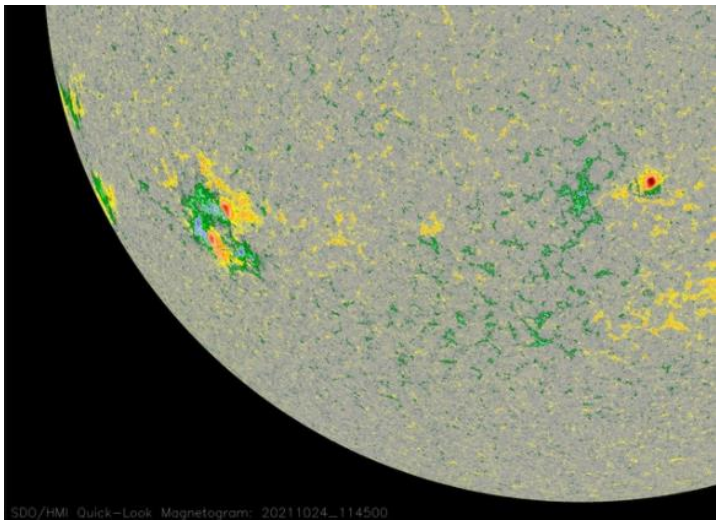
Geomagnetic Storms:

No coronal hole influences are expected over the four-day period. No CMEs currently feature either, and the geomagnetic forecast is expected to be Quiet throughout as a result.
STEREO A PLASTIC measurements show a slow solar wind environment for the next three days (near 350km/s), while the coronal hole responsible for activity on last rotation extending from the northern crown only exists as a vestigial eastward-shifted remnant (CH15/+), with this both unlikely to be significant, and unlikely to arrive within the next four days.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: HMI Colourised Magnetogram shows AR2886 (right) AR2887 (centre) with two emerging regions on the left.



Radio Blackouts - X-Ray Flares:

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The X-ray forecast is the only aspect of space weather expected to depart from background conditions in the period, with a daily Slight Chance of M-class flares.
This is largely the result of sunspot region AR2887 in the southeast quadrant, which currently is assessed as having Dki/Beta complexity and has shown a recent growth trend. Perhaps because of its age, the raw X-ray probabilities appear to be over-estimates (for lack of even C-class activity this far during its occupancy of the Earth-facing disc), and probabilities have therefore been revised downwards to a daily 50% Chance of C-class and 10% of M.
The prospects for significant X-ray activity may increase in the four days however - there is currently two bright flux regions lying on the southeastern limb, there may be a small spot in at least one of these regions, this will become apparent as they rotate onto the visible disk. Added to this, the Carrington location for returning region AR2883 lies a couple of days behind the northeastern limb, and may well bolster the risk of flares should it have survived the far-side crossing, and indeed EUVI195 imagery on STEREO A suggests that it has.
The potential spots do not yet feature in the current forecast, with the risk of significant flares therefore held at a daily 10% Slight Chance for M-class due to AR2887 alone.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

With no significant sunspots in geoeffective positions on the Sun, solar radiation storms are currently not expected.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux is currently at Normal Background levels, having failed to respond to the recent exit from coronal hole 13's high speed stream. With no further enhancements expected in the four-day forecast period Normal Background flux and sub-Active fluence should persist throughout.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	1

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